PATENT SPECIFICATION

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Complete Specification Left: May 1, 1940.

Complete Specification Accepted: Nov. 5, 1940.

PROVISIONAL SPECIFICATION

Improvements in or relating to Cathode Ray Tube Television Receivers and to Optical Projection Systems therefor

We, SCOPHONY LIMITED, a Company formed according to the laws of Great Britain, and FERENC OKOLICSANYI, a Hungarian Subject, both of Thornwood Lodge, Campden Hill, London, W.8, do hereby declare the nature of this invention to be as follows:—

The present invention relates to television receivers of the type employing a cathode ray tube and optical means for forming on a projection screen an enlarged image of the picture reproduced on the image screen of the cathode ray tube.

The invention also relates to an improved form of such optical means.

According to the invention, there is provided a cathode ray tube television receiver which is adapted to produce on the image screen of the cathode ray tube a picture having its dimension contracted in the frame scanning direction, and which is provided with an optical projection system comprising two crossed cylindrical optical elements, which system has such a greater magnifying power in the frame scanning direction than in the line scanning direction that in the final projected picture the frame dimension is restored to its correct magnitude.

According to the invention in another aspect there is provided an optical projection system for use in conjunction with a cathode ray tube television receiver the said system comprising two crossed cylindrical optical elements, and being such that, when, placed in the operative position, its greater magnifying power is in the frame scanning direction.

An optical system of this type has considerable advantages over the more usual spherical projection lens. The separate cylindrical members can be made of large size and large optical aperture and can yet be corrected without the cost becoming prohibitive. The large size of these elements enables them to have a long focal length for a given aperture, thus enabling a given picture size to be obtained with a long throw. This is of importance when the apparatus is used in a cinema, since it enables the apparatus to be installed in the operator's booth instead of in the auditorium. Also, the large size of the optical elements enables a cathode ray tube of large size to be employed instead of the usual small tubes used for projection purposes, thus increasing the available light flux.

When using a cathode ray tube for projection purposes it is customary to employ a special electron-optical focussing system to give a spot which is somewhat larger in the frame scanning direction than in the line scanning direction, in order to avoid the appearance of strips in the projected image. When employing the present invention, this result is achieved with the use of a normal spot, owing to the contraction of the picture in the frame scanning direction.

In a preferred embodiment of the invention, the cylindrical elements comprise cylindrical mirrors formed of silvered sheets of celluloid or the like, secured to bearing members cut to the required curve. In this way, corrected elements of any size can easily be obtained. Alternatively two opposite edges of the celluloid sheets can be secured to long rollers arranged to pivot about axes parallel to these edges. If the rollers are moved bodily towards one another the sheet will be compressed and will adopt a cylindrical shape, and if the rollers are then rotated slightly and fixed in position, this cylindrical shape can be modified slightly to give a number of different curvatures for the purpose of optical correction.

One such mirror, curved in the frame scanning direction faces the fluorescent screen of the cathode ray tube and reflects the light therefrom on to the second and much larger mirror which surrounds the end of the cathode ray tube and faces the projection screen. This second mirror is curved in the line scanning direction, and its silvering is interrupted in the centre, leaving a transparent window through which the light from the fluorescent screen reaches the first mirror. Owing to the smaller optical distance between the first mirror and the fluorescent screen, the magnification in the frame scanning direction is greater than in the line

scanning direction. The necessary contraction of the picture on the fluorescent screen in the frame scanning direction is obtained by adjusting the appropriate time-base circuit to give a smaller sweep in this direction.

Dated this 1st day of May, 1939.
T. BROWN,
Chartered Patent Agent,
Thornwood Lodge, Campden Hill,
London, W.8,
Agent for the Applicants.

COMPLETE SPECIFICATION

Improvements in or relating to Cathode Ray Tube Television Receivers and to Optical Projection Systems therefor

We, SCOPHONY LIMITED, a Company formed according to the laws of Great Britain, and FERENC OKOLICSANYI, a Hungarian Subject, both of Thornwood Lodge, Campden Hill, London, W.8, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to television receivers of the type employing a cathode ray tube and optical means for forming on a projection screen an enlarged image of the picture reproduced on the image screen of the cathode ray tube.

The invention also relates to an improved form of such optical means.

According to the invention, there is provided a cathode ray tube television receiver which is adapted to produce on the image screen of the cathode ray tube a picture having its dimension contracted in the frame scanning direction, and which is provided with an optical projection system comprising two crossed cylindrical optical elements, which system has such a greater magnifying power in the frame scanning direction than in the line scanning direction that in the final projected picture the frame dimension is restored to its correct magnitude.

According to the invention in another aspect there is provided an optical projection system for use in conjunction with a cathode ray tube television receiver the said system comprising two crossed cylindrical optical elements, and being such that, when placed in the operative position, its greater magnifying power is in the frame scanning direction.

An optical system of this type has considerable advantages over the more usual spherical projection lens. The separate cylindrical members can be made of large size and large optical aperture and can yet be corrected without the cost becoming prohibitive. The large size of these elements enables them to have a long focal length for a given aperture, thus enabling a given picture size to be obtained with a long throw. This is of importance when the apparatus is used in a cinema, since it enables the apparatus to be installed in the operator's booth instead of in the auditorium. Also, the large size of the optical elements enables a cathode ray tube of large size to be employed instead of the usual small tubes used for projection purposes, thus increasing the available light flux.

The invention will now be described with reference to the accompanying drawings in which

Fig. 1 shows an arrangement in accordance with the present invention using mirrors.

Figs. 2 and 3 are explanatory diagrams and

Figs. 4 and 5 show diagrammatically two views of an arrangement using lenses.

In a preferred embodiment of the invention shown in Fig. 1, the cylindrical elements comprise cylindrical mirrors 1 and 2 formed of silvered sheets 1*a* and 2*a* of celluloid or the like, secured to bearing members 1*b* and 2*b* cut to the required curve. In this way, corrected elements of any size can easily be obtained.

The mirror 1, curved in the frame scanning direction faces the fluorescent image screen 3 of the cathode ray tube 4 and reflects the light therefrom on to the second and much larger mirror 2 which surrounds the end of the cathode ray tube 4 and faces the projection screen 5. This second mirror 2 is curved in the line scanning direction, and its silvering is interrupted in the centre, leaving a transparent window 6 through which the light from the fluorescent screen 3 reaches the first mirror 1. Owing to the smaller optical distance between the first mirror 1 and the fluorescent screen 3, the magnification in the frame scanning direction is greater than in the line scanning direction. The necessary contraction of the picture 7 on the fluorescent screen in the frame scanning direction is obtained by adjusting the appropriate time-base circuit 8 to give a smaller

sweep in this direction. For this purpose no fundamental change from the normal circuit is required. All that is necessary is to adjust the amplitude of the output in any suitable manner.

The television receiver signal separator and line scanning time base circuit indicated at 9 is of the usual kind.

In the example shown, the picture on the cathode ray tube is 10 inches × 4 inches. The mirror 1 is 4 feet from the fluorescent screen 3, and the distance between the latter and the projection screen 5 is 150 feet. The focal length of the mirror 1 is given by the expression

$$\frac{1}{f_1} = \frac{1}{4} + \frac{1}{154}$$

and that of the mirror 2 by

$$\frac{1}{f_2} = \frac{1}{8} + \frac{1}{150}$$

The mirror 1 may be approximately 2 feet square and the mirror 2 approximately 4 feet square.

When using a cathode ray tube for projection purposes it is customary to employ a special electron-optical focussing system to give a spot which is somewhat larger in the frame scanning direction than in the line scanning direction, in order to avoid the appearance of strips in the projected image. When employing the present invention, this result is achieved with the use of a normal spot, owing to the contraction of the picture in the frame scanning direction.

This may be further explained with reference to Figs. 2 and 3. In Fig. 2 is shown an 8″ × 10″ frame. At 11 is shown scanning by a circular spot which is exactly the width of one scanning line. This gives the full transmitted definition, but it is found that the "raster" is visible, and that inter-line flicker is noticeable. To get over this difficulty, it is customary to make the spot cover two lines, as shown at 12. This removes the disadvantages mentioned above, but unnecessarily reduces the definition in the line scanning direction. At 13 is shown a further proposal, in which the scanning spot is made elongated in the frame scanning direction, thus removing the disadvantages of the spot in 11, and keeping full definition in the line scanning direction which was lost in 12. However a further disadvantage arises in the method 13, in that the electron-optical focussing system needed to produce this spot is complicated and difficult to design.

Fig. 3 shows an arrangement in accordance with the present invention. The spot size is kept as in 11, but the picture is reduced to 4″ × 10″, i.e. is halved in the frame scanning direction.

The invention is not limited to the use of mirrors. A lens system may be used, as shown in Figs. 4 and 5. The image on the screen 3 of the tube 4 is projected on to the projection screen 5 by means of two lenses 14 and 15. Fig. 4 shows the arrangement in the plane of the frame scanning direction, and the lens 14 nearer the screen has power in this plane. In the plane of the line scanning direction shown in Fig. 5, the lens 14 has no power and the lens 15 has power. The image will thus be magnified more in the plane of Fig. 4 than in the plane of Fig. 5.

In the arrangement of Fig. 1 the mirrors may be of the kind known as "Mangin" mirrors which are corrected for chromatic and spherical aberrations. This is done by having the reflecting surface of the mirror on the back surface of a sheet of transparent material which has a different curvature on the front surface from the back surface.

It will be understood that in any of the embodiments described, the optical elements need not be purely cylindrical. One or both may be sphero-cylindrical or of any other suitable form, so long as in each the focussing power in one plane is greater than the other.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A cathode ray tube television receiver which is adapted to produce on the image screen of the cathode ray tube a picture having its dimension contracted in the frame scanning direction, and which is provided with an optical projection system comprising two crossed cylindrical optical elements, which system has such a greater magnifying power in the frame scanning direction than in the line scanning direction that in the final projected picture the frame dimension is restored to its correct magnitude.

2. An optical projection system for use in conjunction with a cathode ray tube television receiver the said system comprising two crossed cylindrical optical elements, and being such that, when, placed in the operative position, its greater magnifying power is in the frame scanning direction.

3. Apparatus according to Claim 1 or 2 wherein said optical elements comprise lenses.

4. Apparatus according to Claim 1 or 2 wherein said optical elements comprise mirrors; there being provided one mirror

facing the image screen of the cathode ray tube and having optical power in the frame scanning direction, and a second mirror provided with an aperture through which light from the image screen passes to the first mirror and arranged facing the projection screen and having power in the line scanning direction.

5. Apparatus according to Claim 4 wherein said mirrors are of the kind known as "Mangin" mirrors.

6. Television receivers substantially as herein described with reference to the accompanying drawing.

7. Optical projection systems substantially as herein described with reference to the accompanying drawing.

Dated this 1st day of May, 1940.

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London, W.8.
Agent for the Applicants.

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Fig. 1.

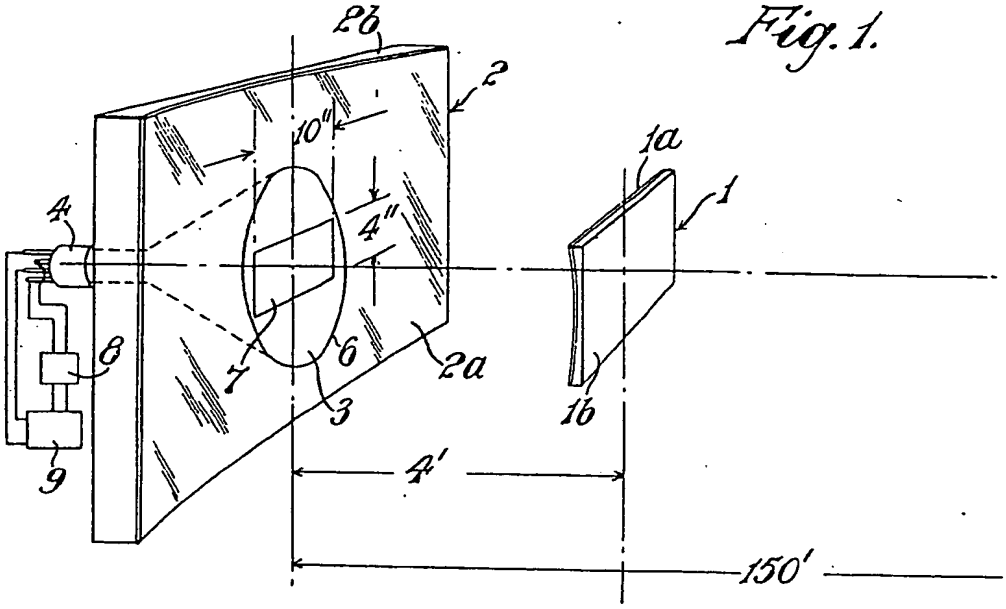


Fig. 2.

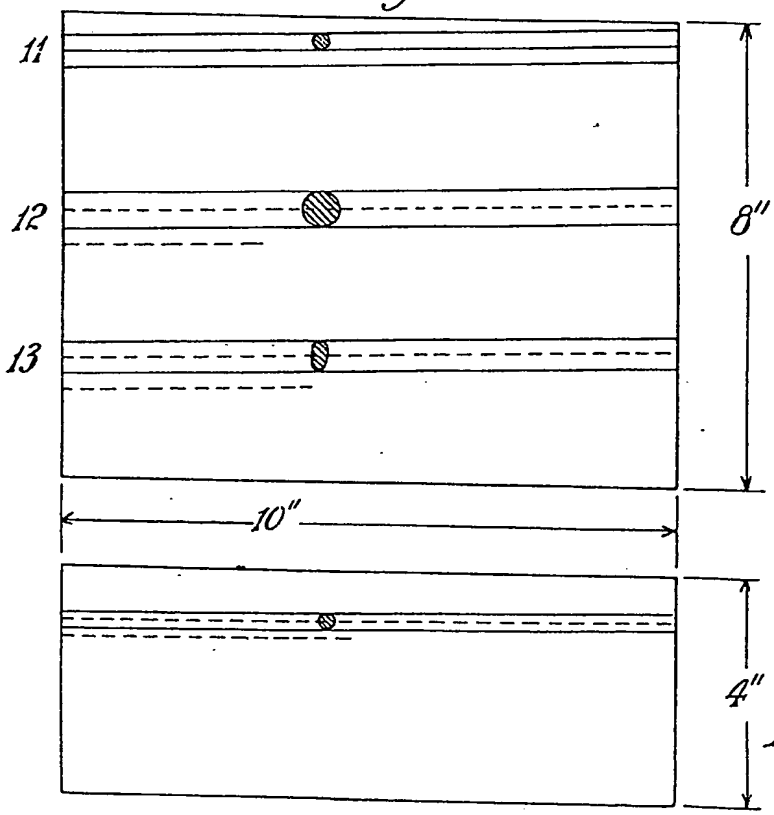
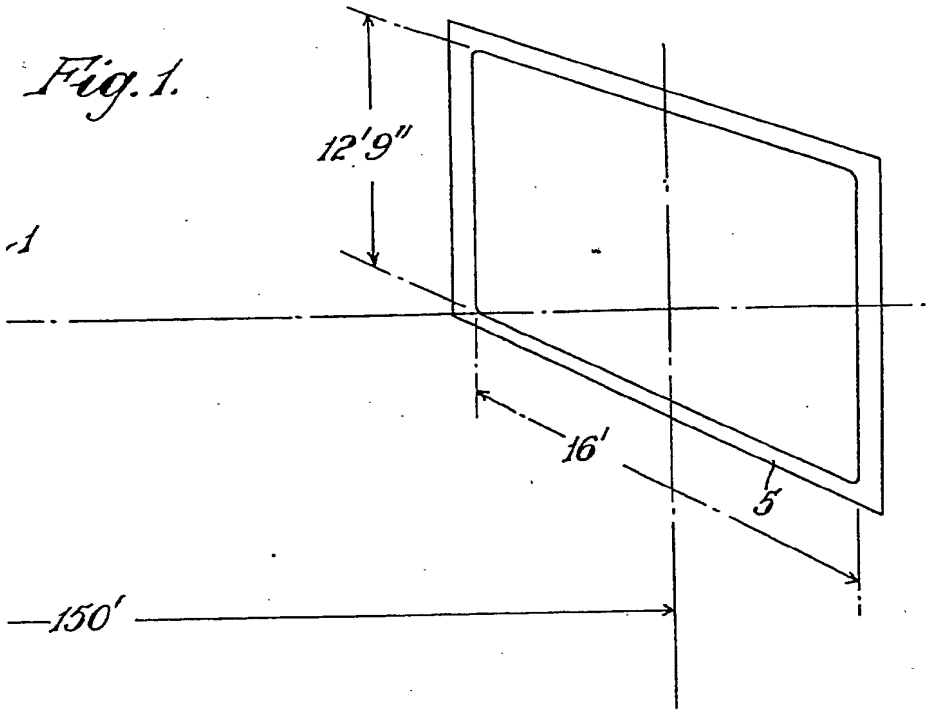


Fig. 3.

Fig. 1.



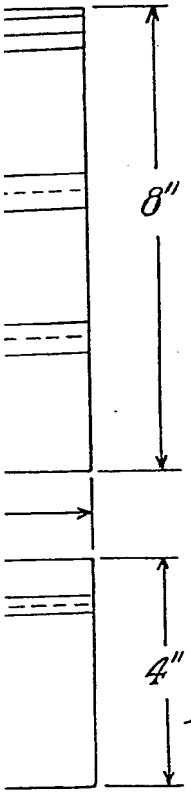


Fig. 3.

Fig. 4.

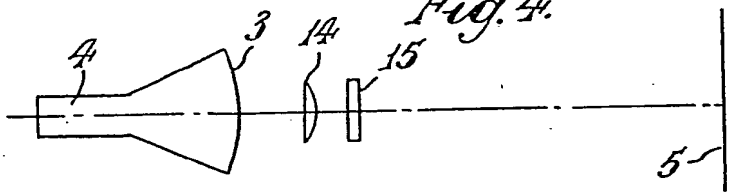


Fig. 5.

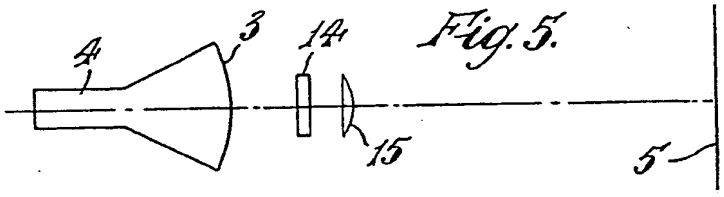


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Fig. 1.

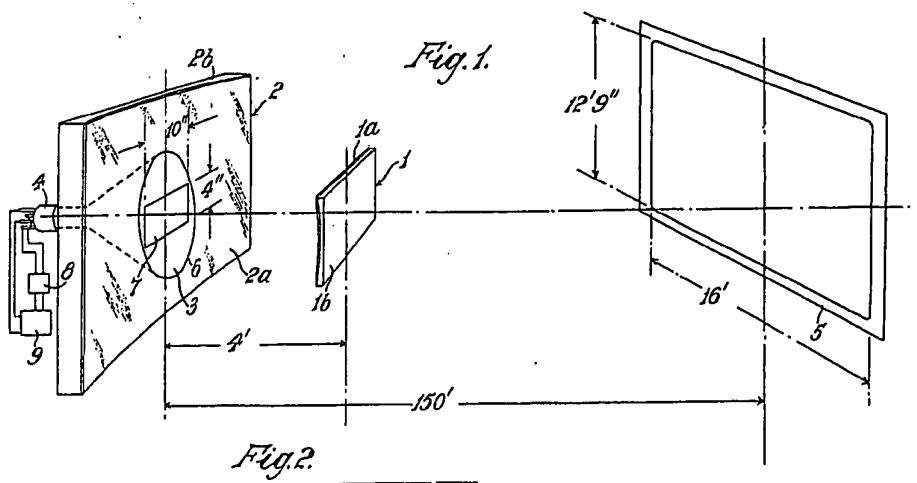


Fig. 2.

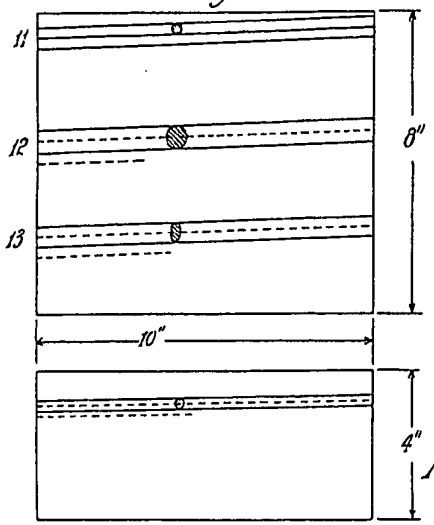


Fig. 3.

Fig. 4.

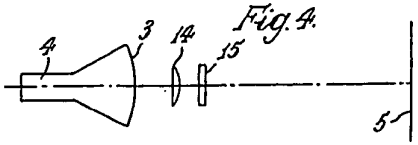
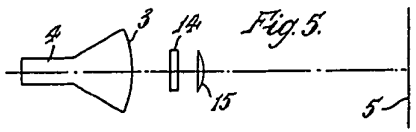


Fig. 5.



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